

**What is claimed is:**

1. A fitness function circuit for determining the fitness of a potential solution for a genetic algorithm problem, said fitness circuit comprising:

a solution register containing said potential solution for said genetic algorithm problem therein, said solution register comprising a plurality of component parts thereof;

a plurality of data tables, the number of data tables corresponding to the number of said component parts of said solution register, respective data tables having inputs from two respective ones of said component parts of said solution register, each of said data tables comprising a matrix of partial solutions to said genetic algorithm problem, the two respective ones of said component parts determining a particular respective partial solution, each of said matrices having identical entries therein; and

an adder connected to each of said plurality of data tables, said adder adding respective partial solutions from each of said plurality of data tables, thereby determining the fitness of said potential solution for said genetic algorithm problem.

2. The fitness function circuit according to claim 1, wherein said data tables include partial solutions specific to the sequential order of the potential solution.

3. The fitness function circuit according to claim 1, wherein said adder adds said partial solutions from the respective data tables in parallel.

4. The fitness function circuit according to claim 3, wherein said partial solutions from the respective data tables are added substantially simultaneously.

5. The fitness function circuit according to claim 1, wherein each of said matrices within said data tables comprises an abbreviated matrix of partial solutions to said genetic algorithm problem.

6. The fitness function circuit according to claim 5, wherein said abbreviated matrix contains at least  $(n)(n-1)/2$  entries.

7. The fitness function circuit according to claim 1, wherein at least two of the two respective ones of said component parts correspond to different entries within said matrices.

8. The fitness function circuit according to claim 7, wherein all of the two respective ones of said component parts correspond to different entries within said matrices.

9. The fitness function circuit according to claim 8, wherein said genetic algorithm problem is the Traveling Salesman Problem.

10. A method for determining the fitness of a potential solution for a genetic algorithm problem, said method comprising the steps of:

1 inputting a plurality of potential solution values into a solution register, said  
2 solution register comprising a plurality of component parts thereof;

3 receiving, after said step of inputting, at each of a plurality of data tables two  
4 respective ones of said component parts of said solution register, the number of data  
5 tables corresponding to the number of said component parts of said solution register, each  
6 of said data tables comprising a matrix of partial solutions to said genetic algorithm  
7 problem, each of the matrices having identical entries therein;

8 indexing said matrices of partial solutions to said genetic algorithm within said  
9 plurality of data tables, the two respective ones of said component parts determining  
10 respective particular partial solutions within the respective matrices; and

11 adding, by an adder connected to each of the respective data tables, respective  
12 outputs from each of said data tables, whereby the sum of said adder determines the  
13 fitness of said potential solution for said genetic algorithm problem.

14 11. The method according to claim 10, wherein in said step of receiving, at each of  
15 said plurality of data tables, two respective ones of said component parts of said solution  
16 register are received substantially simultaneously.

17 12. The method according to claim 10, wherein in said step of receiving, wherein at  
18 least two of the two respective ones of said component parts correspond to different  
19 entries within said matrices.

20 13. The method according to claim 12, wherein all of the two respective ones of said  
21 component parts correspond to different entries within said matrices.

22 14. The method according to claim 13, wherein said genetic algorithm problem is the  
23 Traveling Salesman Problem.

24 15. The method according to claim 10, wherein in said step of receiving, at each of  
25 said plurality of data tables, two respective ones of said component parts of said solution  
26 register correspond to the sequential order of the potential solution values in said solution  
27 register.

28 16. A methodology for determining the fitness of a particular potential solution for a  
29 genetic algorithm problem from a pool of potential solutions, said methodology  
30 comprising steps of:

31 (a) inputting a plurality of potential solution values into a solution register, said  
32 solution register comprising a plurality of component parts thereof;

33 (b) receiving, substantially simultaneously, at each of a plurality of data tables two  
34 respective ones of said component parts of said solution register, the number of data

1 tables corresponding to the number of said component parts of said solution register, each  
2 of said data tables comprising a matrix of partial solutions specific to said genetic  
3 algorithm problem, each of the matrices having identical entries therein;

4 (c) indexing said matrices of partial solutions to said genetic algorithm within said  
5 plurality of data tables, the two respective ones of said component parts determining  
6 respective particular partial solutions within the respective matrices;

7 (d) adding, by an adder connected to each of the respective data tables, respective  
8 outputs from each of said data tables in parallel, whereby the sum of said adder  
9 determines the fitness of said particular potential solution for said genetic algorithm  
10 problem;

11 (e) comparing the fitness of said particular potential solution to a fitness threshold;  
12 and

13 (f) replacing a prior potential solution from said pool of potential solutions with  
14 said particular potential solution if said fitness of said particular potential solution  
15 exceeds said fitness threshold, and otherwise deleting said particular potential solution.

16 17. The methodology according to claim 16, said methodology repeating said steps (a)  
17 – (f) with another particular potential solution with the same matrix of partial solutions.

18 18. The methodology according to claim 16, said methodology repeating said steps (a)  
19 – (f) with another particular potential solution with another matrix of partial solutions,  
20 said another matrix corresponding to partial solutions for another genetic algorithm  
21 problem.